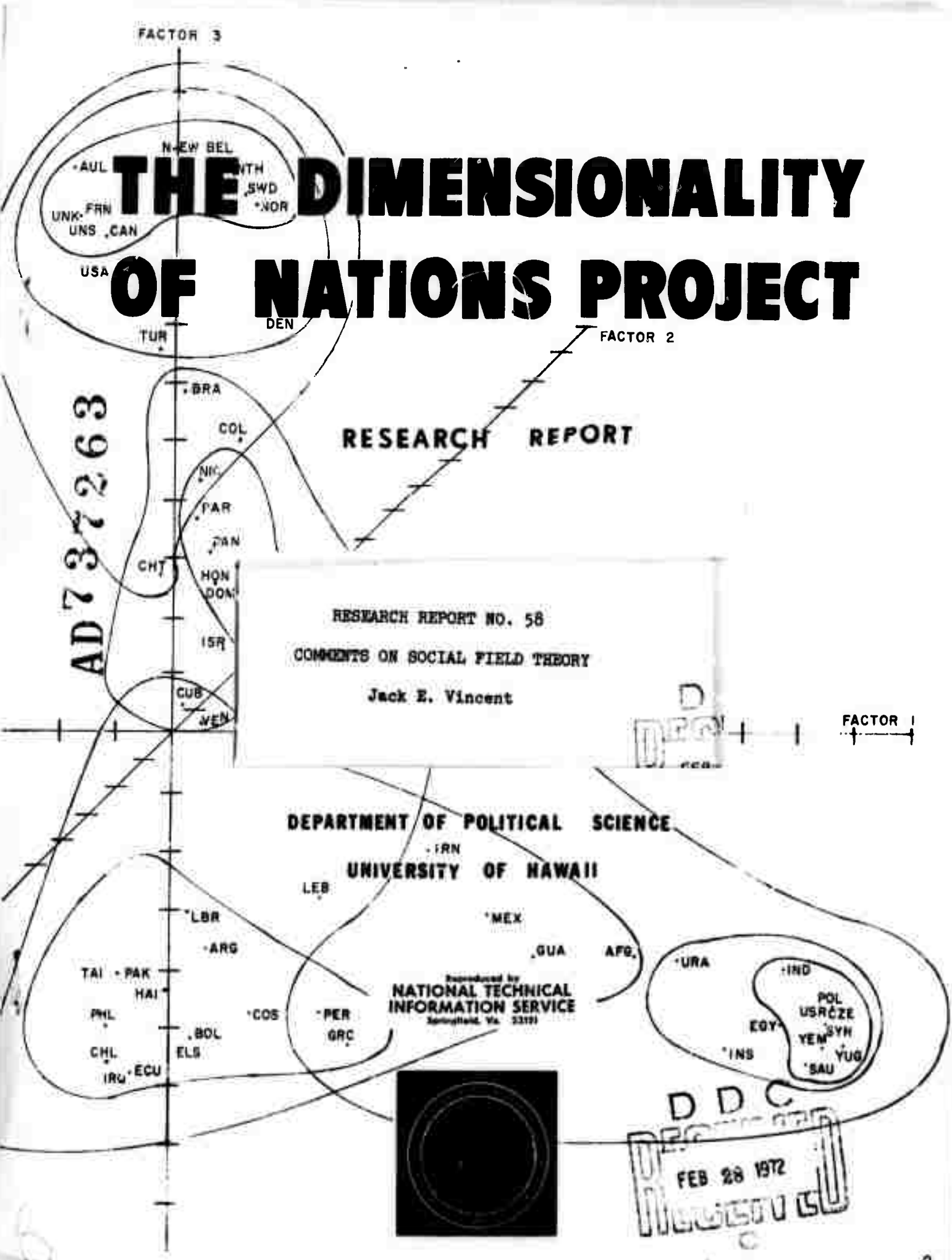

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COMMENTS ON SOCIAL FIELD THEORY

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DEPARTMENT OF POLITICAL SCIENCE

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THE DIMENSIONALITY OF NATIONS PROJECT
Department of Political Science
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13. ABSTRACT

The purpose of this paper is to stimulate a discussion of Social Field as developed by R. J. Rummel in various DON Research Reports and elsewhere. It should be understood that the commentary comes from a "friendly critic" in the sense that I view Rummel's theoretical elaborations as the most promising developments in international relations in the last decade.

My comments, for the most part, will range over matters that have concerned me as I have perused and utilized various research reports. That is, there appears to be certain problem areas associated with the development of Social Field Theory, common to all or several research reports. After the more general treatment, I will attempt a focused critique of the most recent developments called "Status-Field Theory."

The topics developed will be: (1) What is Social Field Theory? (2) Interpretation of the Basic Formulae; (3) The Dynamics of the Spaces Problem; (4) The Time and Space Frame Problem; (5) The Basis Problem; (6) Model II and the Notion of Theory; (7) The Concept of Distance and Its Implications; (8) The Use and Interpretation of Canonical Correlation; and (9) The Development of Status-Field Theory.

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COMMENTS ON SOCIAL FIELD THEORY*

Jack E. Vincent
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The purpose of this paper is to stimulate a discussion of Social Field as developed by R. J. Rummel in various DON Research Reports and elsewhere.[1] It should be understood that the commentary comes from a "friendly critic" in the sense that I view Rummel's theoretical elaborations as the most promising developments in international relations in the last decade.

My comments, for the most part, will range over matters that have concerned me as I have perused and utilized various research reports. That is, there appears to be certain problem areas associated with the development of Social Field Theory, common to all or several research reports. After the more general treatment, I will attempt a focused critique of the most recent developments called "Status-Field Theory."

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*I would like to thank R. J. Rummel for his careful review of this manuscript.

[1]See the various Dimensionality of Nations Project's Research Reports (University of Hawaii). R. J. Rummel treats the philosophical roots and history of DON as well as those of Social Field Theory in the various research reports, so that task will not be repeated here. A good summarizing report, however, is R. J. Rummel, "The DON Project: A Five-Year Program," Research Report No. 9, The Dimensionality of Nations Project, University of Hawaii, 1967.

Problem, (6) Model II and the Notion of Theory, (7) The Concept of Distance and Its Implications, (8) The Use and Interpretation of Canonical Correlation, and (9) The Development of Status-Field Theory.

What is Social Field Theory?

Social Field Theory may be defined as a set of interrelated statements and formulae that assert that the behavior of nation i and nation j are predicted from the distances of i from j in respect to their attributes. In testing the theory, distances are computed (i - j) using factor score location of the nations, based on a factor analysis of attributes.[2] (The nations' scores on the attributes, such as

[2]For discussions and applications of factor analysis, see: Harry H. Harman, Modern Factor Analysis (Chicago: University of Chicago Press, 1960); Henry F. Kaiser, "The Varimax Criterion for Analytical Rotation in Factor Analysis," Psychometrika, 23 (1958), pp. 187-200; Henry F. Kaiser, "Computer Program for Varimax Rotation in Factor Analysis," Educational and Psychological Measurements, Vol. 19 (1959), pp. 413-430; Dean J. Clyde, Elliott M. Cramer, Richard J. Sharin, Multivariate Statistical Programs (Coral Gables, Florida: University of Miami, 1966), pp. 15-19; Bruce M. Russett, International Regions in International Integration (Chicago: Rand, McNally, 1968); R. J. Rummel, "Dimensions of Conflict Behavior Within and Between Nations," General Systems, Yearbook for the Advancement of General Systems Theory (Ann Arbor, Michigan, 1963); Arthur S. Banks and Phillip M. Gregg, "Grouping Political Systems Through Factor Analysis of A Cross Polity Survey," The American Behavioral Scientist, Vol. 9 (1965), pp. 3-6; Phillip M. Gregg and Arthur S. Banks, "Dimensions of Political Systems: Factor Analysis of A Cross Polity Survey," American Political Science Review, Vol. 59 (1965), pp. 602-614; Raymond Tanter, "Dimensions of Conflict Behavior Within and Between Nations, 1958-60," Journal of Conflict Resolution, Vol. 10 (1966), pp. 41-64; R. J. Rummel, "Dimensions of Conflict Behavior Within Nations 1946-1959," Journal of Conflict Resolution, Vol. 10 (1966), pp. 65-73; Jack E. Vincent, Factor Analysis in International Relations: Interpretation, Problem Areas and An Application (Gainesville: University of Florida Press, 1971); R. J. Rummel, Applied Factor Analysis (Evanston: Northwestern University Press, 1970); Jack E. Vincent, "Factor Analysis as a Research Tool in International Relations: Some Problems Areas, Some Suggestions and An Application," Proceedings of the 65th Annual Meeting

(continued)

Per Capita GNP and Radios Per 1000 Population, are correlated and then factor analyzed to get the factor scores). Behavior scores are generated from a factor analysis of the correlation matrix of i to j behavioral measures, such as the trade from the U.S. to France, U.S. to the U.S.S.R., France to the U.S., and France to the U.S.S.R. Thus, the behavior factor scores represent "dyadic subjects" on the behavior factor dimensions (and not individual nations as in the case of the attribute dimensions).

In matrix form, the basic relationships may be expressed as: $W_{mk} = DA_k$, where W is a vector of the behavior of m dyads on the k^{th} dimension of behavior, D is the m x q matrix of distance vectors

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[2](Continued)
of the American Political Science Association (New York, 1969); Raymond B. Cattell, "The Meaning and Strategic Use of Factor Analysis," in Raymond B. Cattell (ed.), Handbook of Multivariate Experimental Psychology (Chicago: Rand, McNally & Co., 1966), pp. 174-243; Raymond B. Cattell, "The Basis of Recognition and Interpretation of Factors," Educational and Psychological Measurement, Vol. 22 (1962), pp. 667-695; Jack E. Vincent, "National Attributes as Predictors of Delegate Attitudes at the United Nations," American Political Science Review 62 (1968), pp. 916-931; Jack E. Vincent, "Systematic Analysis of National Attributes," Comparative Political Studies 1 (1968), pp. 431-435; Jack E. Vincent, "The Convergence of Attitude and Voting Patterns at the United Nations," Journal of Politics 31 (1969), pp. 952-983; Jack E. Vincent and James Tindell, "Alternative Cooperative Strategies in a Bargaining Game," Journal of Conflict Resolution 13 (1969), pp. 494-510; Jack E. Vincent, "An Analysis of Attitude Patterns at the United Nations," Quarterly Journal of the Florida Academy of Sciences 32 (1969), pp. 185-209; Jack E. Vincent, "An Analysis of Caucusing Group Activity at the United Nations," Journal of Peace Research 2 (1970), pp. 133-150; Jack E. Vincent, "Scaling the Universe of States on Certain Useful Multivariate Dimensions," Journal of Social Psychology (scheduled for 1971); Jack E. Vincent, "Predicting Voting Patterns in the General Assembly," American Political Science Review 65 (1971), pp. 471-498; Jack E. Vincent, with Joseph Falardeau, Edward Schwerin, Barry Bozeman, and Robert Jednak, "Generating Some Empirically Based Indices for International Alliance and Regional Systems Operating in the Early 1960's," International Studies Quarterly (scheduled for 1971); Jack E. Vincent, "An Application of Attribute Theory to General Assembly Voting Patterns and Some Implications," International Organization (scheduled for 1972); and, Jack E. Vincent and Edward Schwerin, "Ratios of Force and Escalation in a Game Situation," Journal of Conflict Resolution (scheduled for 1972).

between the m dyads on q attribute dimensions, and A_k is a vector of q parameters weighting each of the q columns of distance vectors in D.[3]

When the basic relations are expressed in this form, they are referred to as Model I. It should be apparent from the formula that each nation is weighted the same on each distance dimension. Thus, for example, on the Economic Development dimension,[4] the U.S. distance from the U.S.S.R. is given the same weight as the French distance from the U.S.S.R.

Model II, expressed as: $W_{ik} = D_i A_{ik}$, where W_{ik} is a vector of i's behavior toward all other nations on the k^{th} behavioral dimension, D_i are the corresponding distance vectors on p attribute dimensions, and A_{ik} is a vector of parameters specific to the nation i,[5] allows, it should be apparent, the weights to become actor specific. Thus, the weight applied to the Economic Development dimension distances, say of France from the U.S.S.R., need not be the same as the weight applied to the distance of the U.S. from the U.S.S.R. For example, the weight in the former case might be 1.0 and -1.0 in the latter.

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[3] R. J. Rummel, "Field Theory and Attribute Theories of Nation Behavior: Some Mathematical Interrelationships," Research Report No. 31, The Dimensionality of Nations Project, University of Hawaii, 1969, p. 6.

[4] Economic Development is a name usually given to one of the A-space dimensions, because Economic Development indices load heavily upon it, and is generated in connection with testing the theory.

[5] Ibid., p. 16.

In addition to the basic formulae, certain axioms have also been developed.[6] These are: (1) "international relations is a field consisting of all the attributes and interactions of nations and their complex interrelationships," (2) "the international relations field can be analytically divided into attribute, A, and behavior, B, spaces into which attributes and interactions are projected, respectively, as vectors," (3) "the attribute and behavioral spaces are generated by a finite set of linear independent dimensions," (4) "nations are located as vectors in attribute space and coupled into dyads in behavior space," (5) "the distance vectors in A-space that connect nations are social forces determining location of dyads in B-space," (6) "the direction and velocity of movement over time of a dyad in B-space is along the resolution vector of the forces, d," and (7) "B-space is a sub-space of A-space."[7]

Aspects of these fundamental notions will be discussed later under subsequent topics.

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[6] It will be seen that Social Field Theory Axioms are not the same as Status Field Theory Axioms, although there is some overlap. Rummel views the Status Field Theory Axioms as the highest development in his theoretical elaborations. I include these "older" axioms, at this point, because I wish to critique the entire theoretical evolution and because certain important concepts, stressed in the earlier elaborations, are not given much emphasis in later ones, and yet seem to be important to full theoretical development.

[7] R. J. Rummel, "Field Theory and Indicators of International Behavior," Research Report No. 29, The Dimensionality of Nations Project, University of Hawaii, 1969, pp. 10-17. The wording of the axioms changes somewhat in their development and elaboration. See, for example, R. J. Rummel, "A Social Field Theory of Foreign Conflict Behavior," Peace Research Society Papers, IV, Krakow Conference, 1965, p. 133. Those given in Research Report No. 29 are the most recent version prior to the Status-Field Theory elaborations given in Research Report No. 50.

It should be noted at this point, however, in connection with the basic formulae and axioms, that the theory or theories (Models I and II) limit themselves to dyadic behavior. This immediately raises the question of whether some acts are fundamentally dyadic in the international system, while others are not, and, therefore, are not captured, at least in the formal sense, in the mathematical expressions and axioms given above. In discussing behavior, Rummel argues: "interaction ... is defined as a behavioral act: any action of one nation toward a specific other nation. This action then couples the two nations together. Thus, the exports of Peru to Bolivia is an action coupling the two nations. Two nations so coupled by the actions of one are called a dyad, and the action involved is dyadic behavior."[8]

Does this exhaust what can be considered behavior on the part of states? It should be evident that nations can act toward objects other than other nations in the international system, such as the International Court of Justice, the Security Council, the Economic and Social Council, etc. If such objects were to be treated within Social Field Theory, how would their "distances" from states be determined in order to apply the basic formulae? If all such international structures, toward which states can act, are to be ignored, because such distances cannot be obtained, then isn't an important behavioral component of the international system ignored, by

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[8] R. J. Rummel, "Field Theory and Indicators of International Behavior," op. cit., p. 10.

definition, in Social Field Theory?[9] If one grants this argument, it follows that Social Field Theory is a partial, as opposed to a general, theory of international behavior in that the portion of international behavior not subsumed by the theory will have to be, if we are to attempt to explain all behavior, subsumed under different concepts and expressions.

Interpretation of the Basic Formulae

The above treatment gives what I feel are the typical expressions of Social Field Theory, elaborated in most reports.

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[9]Further discussion of this point is given in Jack E. Vincent, "Testing Some Hypotheses About Delegate Attitudes at the United Nations and Some Implications for Theory Building," Research Report No. 52, The Dimensionality of Nations Project, University of Hawaii, 1971. It is argued:

> Can the attitudinal information gathered in this study be considered dyadic ... I think not. When a delegate expresses an attitude toward an attitude object, such as the Security Council, this would not seem to be a dyadic relation of the kind as when a delegate sends a threat to another nation, such as Japan. That is, subjects of Rummel's studies are nations in dyadic relationships (and their attitude distances explain their dyadic relationships). To include an attitude object, such as the Security Council, as an aspect of a dyad relation, then, is tantamount to including non-national subjects in this study.
>
> In the present study, then, all attitude objects would become subjects whose "attributes," to compute attribute distances, would have to be determined. When we think of dyadic relationships, of course, we normally think of actors who can actually act toward one another, i.e., the United States can act toward Japan, and Japan can act toward the United States. It should be evident that some attitude objects, such as the International Court of Justice, could, conceivably, be seen as falling into an "actor" category, while others, such as attitudes toward the Charter, moral values, UN tax, etc., cannot. The latter attitude objects appear "passive" in nature, in contrast to the former, and, of course, hosts of other passive attitude objects can be easily thought of. (pp. 45-46)

Some ambiguities in respect to these expressions exist, however, and probably should be addressed in subsequent reports to facilitate clarification.

First, the basic relationships are usually expressed in the form, $W_{mk} = DA_k$, which might be called the multiple regression form.[10] That is, in applications, parameter weights can be obtained by individually regressing the dimensions of behavior on the distance vectors. The formula says, in effect, that we expect perfect fit if this is done. The test of the theory, then, appears basically straightforward: "Regress each behavioral dimension separately on all distance vectors and expect, in each case, a perfect fit." Behavior space, then, becomes a sub-space of attribute space, if such a result is obtained.

Elsewhere, a formula for testing the basic relationship is expressed as $WB = DA + U$, where W is the matrix of standardized projections of nation dyads (with the same actor) onto the behavior space dimensions (which are W's columns), B is a parameter matrix weighting these dimensions, D is a matrix of standardized distances (distance vectors) for the dyads, A is the parameter matrix for the distances, and U is the least squares error matrix.[11]

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[10] The discussion here applies to the $W_{ik} = D_i A_{ik}$ formula as well, although it should be remembered that in this latter case, the weights become actor specific.

[11] See R. J. Rummel, "A Status-Field Theory of International Relations," Research Report No. 50, The Dimensionality of Nations Project, University of Hawaii, 1971, p. 77. I use the above formulation because of its concise notation. The canonical expression is also developed in R. J. Rummel, "Field Theory and Indicators of International Behavior," op. cit., p. 24, and used for the tests in that research report.

The application in this latter case is obtained by fitting all the behavior dimensions to the distance vectors simultaneously through the canonical correlation technique.[12]

The question naturally arises: Does the canonical test differ significantly from the multiple regression test? The answer is, it does, in the sense that the parameter weights on the distance side (A-space) cannot be expected to be the same as the parameter weights in the multiple regression case.[13] Hence, the theoretical weights assigned to the distances will vary, depending on the technique employed, multiple regression or canonical correlation.

Further, the behavioral dimensions are combined in the canonical analysis, whereas each is given "individual attention" in the multiple regression case. It is true that the aggregate variance explained will be the same in both cases. That is ΣR^2_i (sum of squares of the multiple R's generated when each behavioral dimension

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[12] See the following literature regarding canonical correlation: Harold Hotelling, "Relations Between Two Sets of Variates," Biometrika, Vol. 28 (1936), pp. 321-377; Harold Hotelling, "The Most Predictable Criterion," Journal of Educational Psychology, Vol. 26 (1953), pp. 139-142; T. W. Anderson, An Introduction to Multivariate Statistical Analysis (New York: John Wiley and Sons, 1958), Chapter 12; M. S. Bartlett, "The Statistical Significance of Canonical Correlations," Biometrika, Vol. 32 (1941), pp. 29-38; Paul Horst, Generalized Canonical Correlations and Their Applications to Experimental Data (Seattle: University of Washington, 1961, mimeographed); Paul Horst, "Relations Among m Sets of Measures," Psychometrika, Vol. 26 (1961); pp. 129-149; M. C. Kendall, A Course in Multivariate Analysis (London: Charles Griffin and Co., 1957), Chapter 5; G. Thompson, "The Maximum Correlation of Two Weighted Batteries," The British Journal of Psychology: Statistical Section, Part 1 (1947), pp. 27-34; and Clyde, Cramer and Sharin, op. cit., pp. 4-8.

[13] That is, the weights will be different unless only one behavioral dimension is given non-zero weight in each of the canonical correlations. In the latter case, the canonical weights on the distances will be the same as the multiple regression weights. In practice, however, we would never expect this to happen.

is regressed on all of the distance vectors) must equal the square of the trace correlation[14] in the canonical analysis. Nevertheless, operationally, the two tests are not identical if we move from the concept of aggregate variance explained to the notion of identifying weights, that is, the proper weights to apply to the distance vectors to predict the behavioral dimensions.[15] In a sense, the concept of "behavioral dimension" becomes obscured in the canonical case because the new dimensions, that is, the canonical variate vectors, are combinations of the previous factor dimensions. As long as the aggregate variance explained does remain the same, the question naturally arises as to why there has been a shift from the multiple

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[14] The trace correlation may be computed by dividing the number of variables in the set of concern (to provide a basis for an estimate of the variance explained in that set) into each canonical correlation squared, summing, and taking the square root, i.e., $T = \Sigma \frac{C^2}{V}$, where T = correlation, C = canonical correlation and V = the set of concern. If each of the two sets of variables are viewed as occupying space, the square of the trace correlation can be viewed as estimating the overlap between the two spaces.

The trace correlation can easily be misunderstood. It can be quite low even though high and significant canonical correlations are produced. Using the A-space, B-space concepts of Social Field Theory, A-space and B-space may not have much in the way of overlap (low trace), even though portions overlapped are highly related. The latter will be reflected in a high or several high canonical correlations. It should be obvious, however, that when T = 0, no non-zero canonical correlation can be generated.

[15] My point can easily be misunderstood. Either set of procedures, multiple regression or canonical analysis, can be used to see if all of the variance of B-space can be accounted for by the distance vectors of A-space. The crucial point is that if we are interested in determining the weights to be given to the dimensions (distances or behavior) we can expect the two tests to give different results in the sense that the weights will not, except in a special case (see footnote 13) be the same.

regression form to the canonical form in respect to the basic equations.

Finally, there seems to be some confusion as to whether the dimensions of A- or B-space are to be linearly independent, as Axiom 3 suggests, or orthogonal. In "A Social Field Theory of Foreign Conflict Behavior," it is argued: "The attribute and behavioral spaces are spanned by a number of independent (orthogonal) dimensions which generate all the vectors within the space."[16] In Research Report No. 50, it is asserted: "Status-field Theory does not define the attribute or behavioral space dimensions as mutually orthogonal (statistically independent). They are only linearly independent. A less restricted condition satisfied when the dimensions are not perfectly correlated."[17] In Research Report No. 9, oblique rotation is used in many of the analyses to discover "the dimensions of nations."[18] In the same report, however, it is asserted: "For every vector space there is a basis containing dimensions which are orthogonal (uncorrelated) to each other. They may be considered as a coordinate system with coordinates at right angles to each other. The orthogonal dimensions of a basis of attribute space defined the state of the system."[19]

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[16] R. J. Rummel, "A Social Field Theory of Foreign Conflict Behavior," op. cit., p. 132.

[17] R. J. Rummel, "A Status-Field Theory of International Relations," op. cit., p. 132.

[18] R. J. Rummel, "The DON Project: A Five Year Program," op. cit., p. 8.

[19] Ibid., p. 27.

The shifting on this important point ought to be clarified. Oblique rotation, of course, does not necessarily lead to correlated dimensions. In terms of the requirements of the theory, however, it would seem that there is no need to utilize oblique solutions. Further, the use of correlated variables in either multiple regression or canonical correlation, complicates the analyses. In canonical correlation, for example, if the variables of the right hand set are orthogonal to each other and likewise for the left hand set, then the weights generated by the canonical analysis may be directly interpreted as the Pearson r correlation coefficients of the variables with the canonical variate scores of the respective sets.

It should be noted that the tests of Models I and II, as given in Research Report No. 29, does not use (strictly) uncorrelated variables to define A-space. Further, it is not discussed whether, when distances are computed on dimensions that are orthogonal, the resulting distance matrix itself is orthogonal.

A number of interpretive advantages will be obtained if perfectly orthogonal predictors are used in each of the two sets, in canonical analysis, and, in the case of independent variables, in the use of multiple regression. In the latter case, if the attribute distance dimensions are represented by orthogonal sets of scores, then the beta coefficients will equal Pearson r correlation coefficients of each of the dimensions with each of the behavioral dimensions selected. For example, if Economic Development is weighted .70 and Density, .50, in respect to

International Organizations, then Economic Development will account for 29 per cent of the variance of International Organizations and Density 25 per cent of the variance.[20] Because the predictors are orthogonal, the variance accounted for by each is unique. It is permissible, therefore, to sum the variance explained by all the predictors to get the aggregate variance explained in the dependent variable. In the above example, if none of the other predictors receive any weight, the aggregate variance explained would be 74 per cent. The total aggregate variance, that is, the total percentage variance explained in B-space by A-space, then, could be ascertained by summing the variance explained in each of the behavioral dimensions and dividing this quantity by the number of behavioral dimensions. Actually, however, in respect to this approach, there is no need to compute the multiple correlation when the predictors are actually orthogonal. One need only run simple correlations between them and the behavioral dimensions. The sum of squares of the simple correlations, as already implied above, will equal the multiple R^2. In short, there are many advantages to be obtained by using perfectly orthogonal vectors in the tests.[21]

The major point of this section is, however, that there does seem to be some question on this point (orthogonal vs. linearly independent dimensions) as one moves across the research reports.

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[20] This example gives the kinds of names usually given to the A- and B-space dimensions in actual applications.

[21] For an extended discussion of this and an example, see Jack E. Vincent, Factor Analysis in International Relations (Gainesville: University of Florida Press, 1971), pp. 40-43.

The Dynamics of the Spaces Problem

It is asserted, in Axiom 7, that "B-space is a sub-space of A-space" where A-space consists of distances between nations on the attribute dimensions and B-space is defined in terms of dyadic factor score location.

Assume, for the sake of argument, that the positive relationship is true for one point in time, for example, 1950. Assume also that it is also true for another point in time, for example, 1951.[22] In addition, assume that the A-space distances change very little (or not at all) between the two time points, but that the B-space dimensions and dyad locations change radically. Impressionistically, I feel that such a situation could occur if the tests were run on 1950 vs. 1951 data. That is, I feel, but I am not certain, that behavior, that is, its dimensions, are less stable than attribute distances. Although it is true that different weighting schemes on the distances could account for all the B-space variation in both periods, even though B-space exhibits more variability over time than A-space, I have some difficulty in understanding, if such a situation did occur, how the distances could be conceived of as "social forces determining locations of dyads in B-space" (Axiom 5). One, of course, would feel most comfortable if changes in distances always accompanied changes in behavior. That is, if distances are

[22] In this discussion, I assume that a proper test of the theory is to separately factor analyze A- and B-space variables and then to regress the B-space dimensions on the A-space distance vectors, for first the year 1950 and then, separately, for the year 1951. If it is held that super-P factor analysis (see footnote 59) is the proper test, then these remarks do not apply, because that technique standardizes the factor scores across time.

the forces, changes in distances should precede changes in behavior. This is not to say that such will not be the case. Intuitively, however, I feel that attributes are much more stable than behavior. This suggests, then, if Axiom 7 is borne out, that a theory of subject location change and/or parameter dynamics might be developed in connection with the behavioral changes.

To repeat the major point, however, in what sense are distances social forces determining behavior if it is found that distances do not change but behavior does? That is, B-space can still be a subspace of A-space, even though A-space is static and B-space dynamic.

The Time and Space Frame Problem

The space-time frame of A- and B-space are not clear to me from reading the research reports. In what way are A- and B-space bounded in terms of time and space, if at all? In applications such as in Research Report No. 29, there is talk of a sample,[23] but a sample of what? In the latest formulations of Social Field Theory, the number of states are considered finite and variables infinite. But, what is this population of finite states? There are approximately 130 states operating in the international system today. If 10 new ones are created, are they viewed as part of the finite list? Each new state will create approximately 130 dyads, so 10 new states would create approximately 1300 dyads, and, depending on the sample analyzed, could considerably affect the results. Does the theory apply to the

[23] R. J. Rummel, "Field Theory and Indicators of International Behavior," op. cit., p. 33.

states which existed in the 1920's, which were less than half the number of states that presently exist in the 1970's? If we use Model I in 1920 and then 1970, do we expect the parameters to be the same? Stretching things a bit, what if other planets are discovered and they have states? Does the theory apply to them? In short, in reading the reports I am never certain of the exact finite population to which the theory or theories presumably apply. If the state list is indeed finite, what are the exact time and space boundaries? In this connection, the same kinds of problems pertain to the variables. Does the term, "infinitude of variables," embrace all variables over all time and all space, and if not, what is meant by the term?

The Basis Problem

The basis problem is related, in part, to the space and time frame problem. Again and again the research reports speak of obtaining a basis of A- and B-space.[24] But exactly what does this mean? What are the conditions under which one can assume that one has a basis of either A- or B-space in Field Theory applications? The basis problem, in turn, relates to the kind of matrix one is dealing with.

To simplify matters, let P stand for a matrix whose rows and columns are both linearly independent and infinite.

Let Q stand for a matrix whose columns are infinite, some

[24] Ibid., p. 27.

of which are linearly independent and some of which are linearly dependent, and whose rows are infinite, some of which are linearly independent and some of which are linearly dependent.

Let T stand for a matrix whose columns are infinite, some of which are linearly independent and some linearly dependent, and whose rows are finite, some of which are linearly independent and some of which linearly dependent.

Let R stand for a matrix whose columns are finite, some of which are linearly independent and some of which linearly dependent, and whose rows are infinite, some of which are linearly independent and some of which linearly dependent.

Let S stand for a matrix whose columns are finite, some of which are linearly independent and some of which dependent, and whose rows are finite, some of which are linearly independent and some of which are linearly dependent.

It should be apparent that, in the case of P, no sample of its rows and columns will yield a basis, nor will a factor analysis using the 1.0 or 0.0 eigenvalue cutoff, of such a sample, yield a basis. The basis of such a matrix, of course, is infinite and no finite sample can generate the basis of such a matrix.

In the case of Q, a factor analysis with a 0.0 eigenvalue cutoff will yield a basis only if the sample happens to contain those rows and columns which are linearly independent. There is no way of knowing, of course, if the sample does in fact contain those linearly independent rows and columns. Every new column or row can be tested to see if it is linearly dependent on the previously obtained rows and columns, but whether it will be or not cannot be

known by an examination of the sample of rows and columns. That is, any new row or column could be linearly independent or linearly dependent.

Concerning T, a factor analysis with a 0.0 eigenvalue cutoff will yield a basis under the same conditions as in the case of Matrix Q. That is, if one samples rows and columns it is possible that such rows and columns form a basis but this cannot be known and each new row or column must be tested to see if it is linearly dependent upon the previously obtained rows and columns. Because rows are finite in this matrix, however, any linearly independent columns equal in number to the finite rows will yield a basis. Thus, if rows equal 7, 7 linearly independent columns will be sufficient to make all remaining columns linearly dependent. Thus, if W is a matrix of behavior, D a matrix of distances, and if D could have the characteristic[25] that its finite rows are equal to its linearly independent columns, then there is appropriate transformation matrix A that will allow the equality W = DA. To put it in other terms, all of the behavior as represented by matrix W could be explained by the distances, as represented by the matrix D, because there is an appropriate transformation matrix A so that W = DA. Now, it should be apparent that, if the matrix D is viewed as a basis for attribute space, under these conditions, any numbers could be substituted for the distances and the equality would still be true. That is, under this condition, Field Theory

[25]We will shortly see that D, if calculated from some other matrix, say, C, cannot be square and non-singular, if C is square and non-singular. I have cast the argument in this form to make my major point as clear as possible.

would become true by definition. However, because of the way D is defined, it cannot be square, when computed from a square matrix (except in the trivial case of 2 x 2 -- in which case it will be singular); that is, its rows cannot be equal to its columns. If C_{nxn} represents the factor dimensions of A-space, when D is computed from C, it must have the order of n (n - 1) x n, and, thus, won't be square. Therefore, even if C is square and non-singular, and, therefore, all "new" n x m columns must be linearly dependent on C, nevertheless, when D is generated from C, "new" n (n - 1) x m columns need not be, (but may be) linearly dependent on D.

So where does this leave the basis problem? When working with a matrix of type T we do not know we have a basis, using a factor analysis with 0.0 eigenvalue cutoff, if we use D to "represent" A-space even though D is derived from C n x n which spans A-space. Thus, the question of whether a basis for A-space has been obtained is always problematic when D "represents" A-space.[26]

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[26]It might be objected, using the above notation, that C, not D, represents A-space and, therefore, the argument is irrelevant. However, Axiom 7 asserts, "B-space is a sub-space of A-space." If D does not "represent" A-space, in what sense is the theory being tested?

In various research reports (see the discussion of canonical analysis), it is frequently asserted that so much of B-space is being accounted for by A-space, using the D matrix in the canonical analysis. This, of course, implies that the D matrix is, in fact, being used to represent A-space in such tests. Also, this discussion seems to point up the possible distinction between attribute space and distance space. Typically, what is actually being related to behavioral space, in application, is distance space, and not attribute space. If the distance space is conceived of as consisting of an infinitude of columns, a D computed from a C, which is square and non-singular, does not necessarily span that distance space, even if C spans attribute space.

But what of W in a WB = DA type expression? If W is square and non-singular,[27] won't the expression be true, by definition, even though D is not square? That is, won't the columns of DA be linearly dependent on W? To put it another way, the columns of W, through appropriate linear combinations, can generate each of the columns of DA, regardless of what members are substituted in the D or A columns. Thus, in working with the matrix of type T, if we know we have a basis for B-space, because the matrix W is square and non-singular, we make the expression WB = DA true, by definition, where W represents the behavior, D the distances, and B & A the appropriate transformation matrices.

The following example should make this point clear.

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[27] It might be objected that Axiom 7, "B-space is a sub-space of A-space," implies that the columns of W will be less than the columns of D, and, since D cannot be square (under the conditions outlined above), neither can W. However, it is necessary to distinguish between the logical implications of the axioms and the tests employed in connection with Field Theory. Although D cannot be square and non-singular, if computed from a C which is square and non-singular, W is directly derived from the factor analysis and can (it is possible) be square and non-singular as used in the tests. If it is argued that such a matrix won't be used in the tests, because of Axiom 7, then the basis of B-space becomes as problematic as the basis of A-space.

To recap on these points, even if C spans attribute space, D will not span, that is, we do not know for certain that it does span distance space (conceptualized as infinite columns). Although Axiom 7 seems to imply that the columns of W will be less than those of D, the empirical methods allow, in fact, W to be square and non-singular. If W is square and non-singular, the expression, WB = DA, will be true by definition. If W is not square, it will not be known whether or not it spans behavioral space. That is, any new arbitrary column may or may not be linearly dependent upon the columns of W. To put it another way, we do not know that we span either the behavioral or distance spaces unless we are working with square and non-singular matrices. Such matrices, however, defeat the purpose of empirical testing.

Let $W_{3x3} = \begin{matrix} 1 & 1 & 3 \\ 2 & 1 & 5 \\ 3 & 6 & 1 \end{matrix}$

$B_{3x3} = \begin{matrix} 5.90 & 5.09 & 2.54 \\ -1.54 & 1.54 & 6.27 \\ 9.54 & 13.45 & 16.72 \end{matrix}$

$D_{3x2} = \begin{matrix} 3 & 5 \\ 4 & 9 \\ 6 & 2 \end{matrix}$

$A_{2x3} = \begin{matrix} 1 & 4 & 8 \\ 6 & 7 & 7 \end{matrix}$

Then, $W_{3x3}B_{3x3} = \begin{matrix} 33 & 47 & 59 \\ 58 & 79 & 95 \\ 18 & 38 & 62 \end{matrix} = F_{3x3}$

And $D_{3x2}A_{2x3} = \begin{matrix} 33 & 47 & 59 \\ 58 & 79 & 95 \\ 18 & 38 & 62 \end{matrix} = G_{3x3}$

Thus, $F_{3x3} = G_{3x3}$ or $W_{3x3}B_{3x3} = D_{3x2}A_{2x3}$

Substitute $X_{3x2} = \begin{matrix} 8 & 4 \\ 2 & 5 \\ 6 & 1 \end{matrix}$ for D_{3x2}

Compute T_{3x3}

$$T_{3x3} = B^{-1}_{3x3} X_{3x2}A_{2x3}$$

$$T = \begin{matrix} -32.72 & -86.09 & -53.72 \\ 15.63 & 42.45 & 76.63 \\ 16.36 & 34.54 & 56.36 \end{matrix}$$

Then, $B_{3x3}T_{3x3} = \begin{matrix} 32 & 60 & 92 \\ 32 & 43 & 91 \\ 12 & 31 & 55 \end{matrix} = Y$

$$\text{And, } X_{3x2}A_{2x3} = \begin{matrix} 32 & 60 & 92 \\ 32 & 43 & 51 \\ 12 & 31 & 55 \end{matrix} = P$$

$$\text{Hence, } Y = P, \text{ or } B_{3x3}T_{3x3} = X_{3x2}A_{2x3}$$

So, if

$$W_{nxn}B_{nxn} = D_{nxm}A_{mxn}$$

we can substitute any X_{nxm} for D_{nxm} and there will be T_{nxn} to allow the equality, where W is a matrix of behavior, D a matrix of distances, X an arbitrary matrix, and B, A & T transformation matrices.

To summarize on this point, when D "represents" A-space, the basis of that space is problematic. When W is square and non-singular, so we know we have a basis of B-space, this very fact (W is nxn and non-singular) makes the expression WB = DA true by definition. In light of these observations, reconsideration of the role of "basis" in the development of the theory, then, seems to be in order.

The "basis problem" also refers to the apparent assumption that a factor analysis of a sample of variables generates a basis for the universe of variables. This notion is developed in connection with Axiom 3 and elsewhere. Recalling the above discussion, considering just attribute space for a moment, factor analysis as employed in these studies cannot generate a basis for the universe because it does not generate a basis even for the sample of variables used. That is, if the factor solution was computed out of .00 eigenvalue or larger, then

the resulting factor dimensions would constitute a basis for the sample. Whether they constitute a basis for the universe, however, as indicated, becomes an empirical question. Because all of the applications of factor analyses I have seen in these studies only compute out to an eigenvalue of 1.0 or larger, the resulting dimensions do not form a basis for the sample space. They approximate the basis but they do not form the basis because by definition, "A basis for E^n is a linearly independent subset of vectors from E^n which spans the entire space."[28] It should be obvious that because communalities of the variables are almost always less than 1.0 when computing out to an eigenvalue of 1.0 or larger, the resulting dimensions cannot span the entire space. To put it another way, linear combinations of the factor scores will not properly locate the original variables in the space. They cannot, because a portion of the original variance of each variable, typically, is not accounted for by the linear combination of the factor scores. The dilemma, of course, is that if a factor solution is used computing out to .00 eigenvalue or larger, there will be, typically, almost as many sets of factor scores as there were original variables, whereas to use the 1.0 cutoff, typically, does not generate a true basis of the original space.

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[28] G. Hadley, Linear Algebra (Reading, Massachusetts: Addison-Westley Publishing Co., Inc., 1961), p. 39.

Model II and the Notion of Theory

I have a vague uneasiness about Model II in respect to its implications for social theory. In contrast, I feel very comfortable with Model I. The latter seems to me to assume the form of the kinds of equations we would expect to find in the physical sciences. That is, in the physical sciences, units of analysis, such as molecules, are assumed to behave in terms of laws that apply to all of them, such as those relating to thermo-dynamics. By positing that the fundamental forces, i.e., attributes, may act uniquely for a set of dyads, as is developed in Model II, seems analogous, to me, to attempting to develop a theory for each molecule in the physical world. It is true that the N of the international world is relatively small and therefore, to attempt to treat each set of dyads individually, may make a certain amount of sense in comparison to the typical N in the physical world. Nevertheless, I am bothered by this notion that we should go to this level in constructing the theory. In what sense can we say that attribute distances cause or, to be more precise, the distance vectors result in, a particular kind of behavior vector when the weights assigned in respect to the linear combination of distance vectors can be unique for each set of dyads? Doesn't this bring us back to an elaborate kind of case study notion? If such were the case, I would have difficulty in understanding what is meant by the notion of a relationship between attributes and behavior. In other words, Model II creates the possibility that no general relationships may be established between attribute distances and behavior. That is, it allows all forces

to be viewed as particular to each set of dyads, a notion which, to me, runs across the grain of "law" as I understand it.

It is possible that this argument degenerates into a game of "what shall be called a theory?" Nevertheless, I do think Model II needs further exposition, especially to make it completely clear that it is likely that there will be as many different sets of parameter weights as there are nations. Assuming that there are at least 10 attribute dimensions and 10 behavior dimensions, this would mean 13,000 different predictive weights, rather mind-staggering when one thinks in terms of parsimony.[29] Model I, in contrast, would generate only 100 predictive weights, using the same dimensions.

Possibly, however, these sets of weights (Model II) when generated, say, on the A-space side, will fall into classes which will allow the kind of simplification I am hoping for. Thus, Class A nations may have close to an x pattern of weights, Class B close to a y pattern of weights, etc. This possibility, however, needs further discussion and elaboration.

The Concept of Distance and Its Implications

The concept of distance seems to vary somewhat with the report examined, as it applies to the basic equations. In Report No. 9, it is stated: "A distance vector may be calculated, ... in the attribute sub-space of the major dimensions, or in the total attribute space of

[29] For example, considering just the U.S. dyadic analysis, there will be a predictive weight for each of the distance vectors for each of the behavioral dimensions. Thus, if there are ten behavioral dimensions, there will be 100 predictive weights for the U.S. 100 x 130 (the number of nations) equals 13,000.

all dimensions. A social distance vector may be computed, for example, on just one dimension, say economic development."[30] An illustration then gives the distance between the Soviet Union and the United States in three-dimensional space.[31] It seems to me it makes considerable difference as to whether the distance vectors are computed from individual dimensions, technically one dimensional sub-spaces, or in multi-dimensional sub-spaces, which is implied, as a possibility, and given in the illustration. Models I and II, as described above, however, seem to drop the idea that we will compute distance from multi-dimensional sub-spaces. In short, this latter decision (to use one dimensional sub-spaces) seems to require explanation.

Also, the distance measure has certain implications which it might prove useful to explore.

$$\text{Assume } b_k = \sum_{\ell=1}^{p} a_\ell \, d_{i-j,\ell}$$

where b_k = a dyadic factor score on the k^{th} factor dimension of B-space, a_ℓ = a parameter, $d_{i-j,\ell}$ = the distance between i and j on the ℓ^{th} dimension of the p dimensions of A-space.

Assume only one dimension of A-space received a non-zero weight to satisfy the above equation, and a = 1.0. It follows that in such a case $b = d_{i-j}$, where $d_{i-j} = i_a - j_a$ and i_a equals i's factor score on the single weighted dimension of A-space and j_a equals j's factor score on the same dimension. If $i_a = 0$, then $d_{i-j} = -j_a$ or $j_a = -d_{i-j}$.

[30] R. J. Rummel, "The DON Project: A Five Year Program," op. cit., p. 30.

[31] Ibid., p. 31.

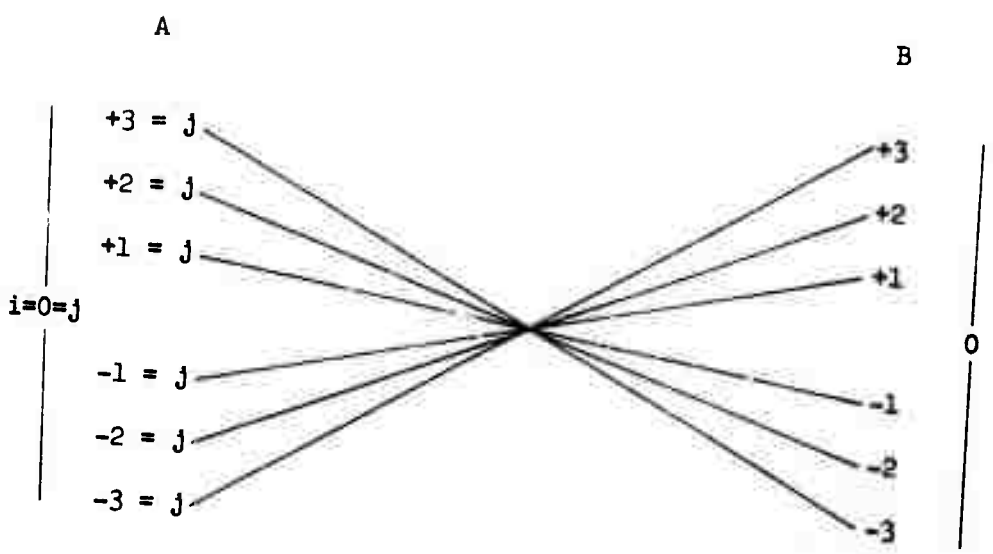
To illustrate this relationship, observe the following table.

TABLE I

If b =	if i_a =	then j_a =	and d_{i-j} =
+3	0	-3	+3
+2	0	-2	+2
+1	0	-1	+1
0	0	0	0
-1	0	+1	-1
-2	0	+2	-2
-3	0	+3	-3

The relationship between the factor scores of A-space of different j's relative to an $i_a = 0$, in respect to the expected value in B-space on the ℓ^{th} dimension may be represented as follows.

TABLE 2



Thus, when $b = 0$, and $i_a = 0$, then $j_a = 0$,

when $b > 0$, and $i_a = 0$, then $j_a < 0$,

when $b < 0$, and $i_a = 0$, then $j_a > 0$.

If $b > 0$ = higher than average interaction,[32]

and $b < 0$ = lower than average interaction,

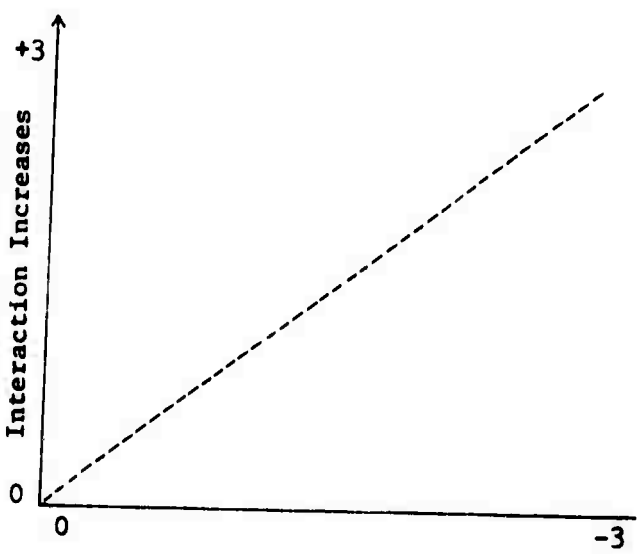
then max $- j_a$ = max b or highest interaction,

and max j_a = min b or lowest interaction.

In other words, an increase in the magnitude of deviations of $-j_a$ from $i_a = 0$, predicts an increase in the degree of interaction, and an increase of the magnitude of deviation of j_a from $i_a = 0$ predicts a decrease of interaction.

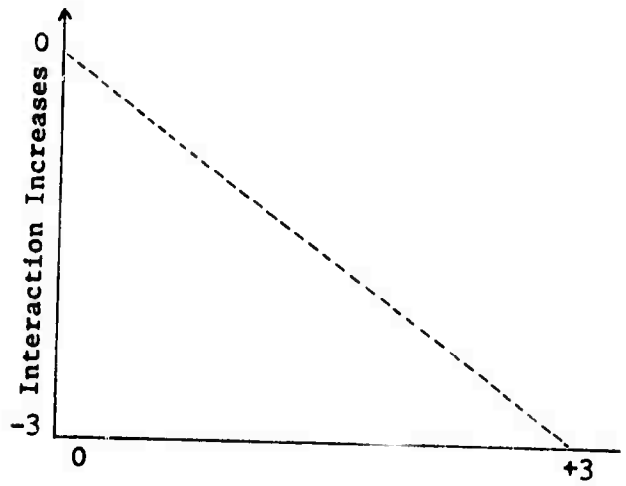
The relationship, then, may be depicted as follows:

Or



Magnitude of Deviations increase and j_a below 0 and $i_a = 0$.

[32]It should be noted that this argument assumes the lowest score on the scale represents the least interaction and the highest score the most. It does not apply to scales where high and low scores reflect something high, such as high = high cooperation and low = high conflict.



Magnitude of Deviations increase and j_a above 0 and $i_a = 0$.

This may be restated as, if $i_a = 0$ and $j_a < 0$, then, if we increase the deviation of j_a from i_a we increase interaction.

If, $i_a = 0$ and $j_a > 0$, then if we increase the deviation of j_a from i_a we decrease interaction.

To illustrate, if economic development is the A-space dimension receiving non-zero weight and trade is the B-space dimension, then with perfect fit we expect:

ECONOMIC DEVELOPMENT

U.S. = 2

Canada = 1

Costa Rica = 0

Paraguay = -1

Chad = -2

to yield:

TRADE

Costa Rica - U.S. = -2

Costa Rica - Canada = -1

Costa Rica - Paraguay = +1

Costa Rica - Chad = +2

or, Costa Rica can be expected to trade most with Chad (largest - deviation), second most with Paraguay (second largest - deviation), third most with Canada (smallest + deviation), and least with the U.S. (largest + deviation).

Note, regardless of the location of i_a, i.e. 0, 1, -1, etc., and if increases in the magnitude of b imply increases in interaction, and a = +1, then + deviations of j_a from i_a imply a suppression of interaction and - deviations of j_a from i_a implied increases in interaction. It naturally follows that if increases in the magnitude of b implies decreases in interaction, then the + and - deviations have the opposite connotations. Also, if a = -1.0, then the above observations of the basic relationships are reversed. That is, when a = -1.0, $i_a = 0$ and $j_a > 0$, then if we increase the deviation of j_a from i_a we should expect an increase in the degree of interaction, if $i_a = 0$ and $j_a < 0$, and we increase the deviation of j_a from i_a we should expect a decrease in interaction where b is a scale where interaction increases with the magnitude of the factor scores.

From the above argument it can be seen that the distance of j from i, in terms of implication for behavior, has opposite connotations depending on whether j is above or below i. This rather important

reversal in expectations is not well developed, to the best of my knowledge, in the research reports. What are the theoretical justifications for such a measure? In this connection, Tong-Whan Park has suggested that still another conception of distance should be employed.[33]

The Use and Interpretation of Canonical Analysis

It has already been pointed out that the multiple regression form of the basic equation is not the same as the canonical form, in the sense that if one is interested in identifying parameter weights for the distances, multiple regression will produce different weights, on the distance vectors, from canonical correlation, in application.

In addition, the interpretation in the research reports of the canonical analyses that have been performed can be questioned.[34] In Research Report No. 29, it is argued: "the analysis shows that

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[33]Tong-Whan Park, "The Role of Distance in International Relations: A New Look at the Social Field Theory," a paper presented to the International Studies Association (New Orleans, 1970). Park would employ distance magnitudes (absolute values of distance) as well as distance vectors in the tests of the theory.

[34]This section can easily be misunderstood. Its purpose is not to undercut the general validity or interpretation of Rummel's results, but merely to suggest that some tightening of language seems to be in order in respect to the treatment of certain results produced by his canonical analyses. Since Rummel has generated considerable interest in Field Theory, and the testing of it, this section may, hopefully, facilitate somewhat greater precision in some aspects of the future work that is likelyto be done. I also include this non-mathematical discussion because there are very few treatments of canonical analysis in the literature and most are highly complex and difficult for a political scientist not well trained in mathematics.

differences between nations on energy consumption per capita and national income can account for sixty-three per cent of the variation in one nation's behavior toward another in terms of translations, tourists, treaties, and cojoining international organizations."[35] Later, it is asserted, "differences in economic development plus power capability did directly account for roughly two-thirds of the variation in such 1955 behavior as translations, tourists, treaties, and comemberships in international organizations."[36] The term, "sixty-three per cent of the variation," was arrived at by squaring the canonical correlation coefficient. This, in fact, refers to the shared variance of the two canonical correlation variate scores, and not the co-variation between the sets of indicators mentioned above. For example, on the behavior side, international organization is weighted -.60. This means that the canonical variate scores, for the behavior side, can account for approximately 36 per cent of the variance in international organizations. To put it another way, the canonical variate scores do not perfectly represent international organizations or any of the other behavioral measures. Because the canonical variate scores are a linear combination of other variables, they only imperfectly reflect any one of those scores that help make up the combination. The square of the canonical correlation, then, does show the co-variation between the two sets of canonical variate scores but does not express the co-variation between those original variables that are combined to make up the canonical

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[35] R. J. Rummel, "Field Theory and Indicators of International Behavior," op. cit., pp. 30-31.

[36] Ibid., p. 39.

variate scores. (The only case in which this would be true is where only one variable on each side was given some weight, other than zero, and the rest of the variables are weighted zero, in which case there would be a perfect correlation between the weighted variables and their canonical variate scores).

A similar problem occurs when the weights generated from the canonical analysis are used to generate predictive equations. For example, in Research Report No. 41, we find the equation .87 CF ≐ -.65 PB + .57 PO, with the weights for the variables indicated derived from the canonical analysis.[37] In connection with this formula, it is asserted "ninety per cent of the variation in U.S. conflict behavior toward the 13 nations was accounted for by power and political orientation distance vectors."[38] This percentage is arrived at by squaring the canonical correlation in which the above weights were generated. As explained above, however, one does not get the proportion of shared variance between the heaviest loading variables from the square of the canonical correlation when other variables are also weighted. A better way of indicating the shared variations is to simply carry out the operations indicated in the equation and then see what the actual simple r^2 is. For example, in connection with the equation given above, one can multiply the power basis distance by -.65 and add it to .57 of the distance on political orientation to create an index.

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[37] R. J. Rummel, "U.S. Foreign Relations: Conflict, Cooperation, and Attribute Distances," Research Report No. 41, The Dimensionality of Nations Project, University of Hawaii, 1970, p. 43. Rummel uses the notion ≐ to indicate approximately equal. As explained above, another set of procedures would allow less ambiguity in this regard.

[38] Ibid., p. 43.

This index could then be correlated with the conflict behavior scores to determine the relationship. (There is no need, in this connection, to multiply the conflict behavior scores by .87 because any multiplication by a constant, or for that matter, division, addition, or subtraction, will still yield the same magnitude of correlation.) In other words, there is likely to be considerable discrepancy between the square of the canonical correlation and the square of the simple correlation (arrived at by these alternative procedures). To rely on the square of the canonical correlation may grossly inflate the presumed relationship, when the focus is on the heaviest weights, as applied throughout Research Report No. 41.

An additional problem also seems to occur in Research Report No. 35, where it is stated, "two strongest canonical relationships account for 18.7 and 10.2 per cent of variation in B-space separately."[39] These percentages are arrived at by squaring the canonical correlation coefficients. I have already indicated that the factor dimensions (1.0 eigenvalue cutoff) of neither A-space nor B-space can be viewed as a true basis for their respective spaces. The above statement, however, goes even further and implies that the canonical variate scores may be viewed as a basis of such spaces. A moment's reflection should show that this cannot be the case. To put it another way, the square of the canonical correlation coefficient only measures the co-variation of the canonical variate scores and does not reveal the co-variation between the two spaces. To put the whole matter in other terms, the factor

[39] Tong-Whan Park, "Asian Conflict in Systematic Perspective: Application of Field Theory (1955 and 1963)," Research Report No. 35, The Dimensionality of Nations Project, University of Hawaii, 1969, p. 91.

dimensions imperfectly span A- and B-spaces, defined in terms of the original variables, while the canonical variate scores of a particular canonical correlation do not span either A- or B-space, even if they are defined solely in terms of the distance and behavioral factor dimension scores.[40]

The Development of Status-Field Theory

In this section I will restrict my comments to Research Report No. 50, which incorporates the latest developments of Social Field Theory (in the sense that the report attempts to mathematize status notions and incorporate them into Social Field Theory).

In part, Research Report No. 50 appears to be an effort to respond to a possible criticism of Social Field Theory, as previously developed -- that it is primarily skeletal in nature. That is, although Social Field Theory asserts that there should be a relationship between the distances of i and j and their behavior to one another, the kinds and directions of these linkages are not specified. In attempting to specify such linkages, Rummel has chosen to work in a narrow range.

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[40] The trace correlation discussed earlier does measure the overlap between the two sets of variables included in the analysis. Even if the trace correlation was focused upon, however, instead of individual canonical correlations, we could sitll not speak of the overlap between A- and B-space, if we are thinking in terms of the original variables, for the reasons given above. If we are thinking of the behavioral space dimensions (W) and the distance vectors (D), each "representing" B- and A-spaces, then the canonical variate scores (collectively, on their respective sides) can be viewed as bases of the spaces, if the dimensions of B-space are equal in number to the rank of D, or, a basis for the "smaller side," if the dimensions of B-space (W) are unequal in number to the rank of D.

Previously it was pointed out that Social Field Theory cannot be viewed as general theory because of its focus on dyadic relations. If Status-Field Theory is viewed as the highest development of Social Field Theory, then it is clear it deals solely with status dependent behavior in the sense of specifying linkages.

In this connection, only two distance dimensions are considered -- Economic Development and Power. It should be pointed out that certain other A-space dimensions, particularly Authoritarianism and U.S. Relations, have been shown to have good predictive power in Attribute Theory applications[41] (and Rummel has shown that there is a mathematical dependency between Attribute Theory and Model I),[42] but linkages are not treated (by definition) for these dimensions in Status-Field Theory.

In summary, on this point, Status-Field Theory is a new elaboration of Social Field Theory which focuses attention on status dependent behavior and, the linkages in this respect are spelled out in connection with the distance dimensions of Economic Development and Power. Although this is certainly a notable forward step in the sense of helping to flesh out the bare bones skeleton of Social Field Theory, it should be recognized that the fleshing operation is

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[41] See: Vincent, "Predicting Voting Patterns in the General Assembly," op. cit.; Vincent, et al., "Generating Some Empirically Based Indices for International Alliance and Regional Systems Operating in the Early 1960's," op. cit.; Vincent, "An Analysis of Attitude Patterns at the United Nations," op. cit.; and Vincent, "An Application of Attribute Theory to General Assembly Voting Patterns and Some Implications," op. cit.

[42] R. J. Rummel, "Field Theory and Attribute Theories of Nation Behavior: Some Mathematical Interrelationships," op. cit., pp. 7-15.

pertinent to only one aspect of the skeleton, whether one is thinking in terms of attributes or behavior.

Rummel begins Research Report No. 50 by pointing out that there are two major theories pertinent to international relations developed in the last decade -- Status Theory, in which Lagos and Galtung have made large contributions, and Social Field Theory, developed primarily by Rummel. Social Field Theory is depicted as being primarily mathematical in nature, but "somewhat barren of substantive meaning and implications,"[43] while Status Theory "seems substantively rich in application."[44] Rummel's primary purpose, then, is to incorporate and mathematize status concepts in which "the stratification system provides the context for behavior and status, the force."[45] In this connection, "combining the two constrains status theory within the field theory mathematical model and operationalizations, and attaches to it field theory's metasociological assumptions about social space, relative values, simultaneity of causation, social time, and attribute distances."[46]

Although Rummel touches on some of these concepts in subsequent discussion, others are ignored, such as the "simultaneity of causation"

[43] R. J. Rummel, "A Status-Field Theory of International Relations," op. cit., p. 2.

[44] Ibid.

[45] Ibid., p. 1. All the axioms, theorems, definitions, and corollaries of Status-Field Theory are given in Appendix C. As explained above, the following discussion will be limited to possibly contentious points in this theoretical collection.

[46] Ibid., p. 3.

and, given the scattered nature of his previous comments on these important concepts, it would seem important to the development of Status-Field Theory to now give them full-blown exposition.

Before proceeding with the problem of integrating the two theories, Rummel presents an overview of both. In describing Social Field Theory, it is reduced, in this treatment, to three axioms, instead of the previous seven: "(1) International Relations is a field consisting of all nation attributes and interactions and their complex interrelationships through time, (2) The international field comprises a Euclidean behavior space defining all nation dyadic interactions, [and] (3) The attribute distances between nations in attribute space at a particular time are social forces determining the location of dyads in behavior space at that time."[47]

In justifying this reduction, Rummel argues, "These three are reduced from the original seven axioms ... of field theory. Since their initial publication, empirical ... and theoretical work ... have shown an interdependence (redundancy) among axioms which, along with some changes in wording, permitted the reduction of the number of the three given here."[48]

In developing status theory, Rummel constructs six axioms. These are: "(1) International relations is a stratified social system, (2) Some behavior dimensions are linearly dependent on status, (3) Status behavior is directed toward higher ranking nations and the greater a nation's rank, the more its status behavior, (4) High rank

[47] Ibid., pp. 5-6.

[48] Ibid., p. 6.

nations support the current international order, (5) Nations emphasize their dominant status and the others' subordinate status in interaction, [and] (6) The more similar in economic development status, the more nations are mutually cooperative."[49]

Elsewhere, in connection with the development of these axioms, Rummel asserts:

> ... two basic behavioral propositions have been argued and tested extensively. The first is that individual or nation interactions increase as a positive function of their rank. High status individuals or nations interact more with others than do low status individuals or nations, and low status individuals or nations direct behavior upward in the status hierarchy.
>
> The second proposition is that status disequilibrated individuals or nations -- those high on some statuses and low on others -- will be frustrated and under stress, potentially leading to internal or external conflict. The group of disequilibrated individuals is a pool of potential suicides, radicals, aggressors, or innovators."[50]

One wonders why this second proposition -- the first seems to be incorporated under Axiom 3 -- is not clearly brought into the axioms, or is this the implication of Axiom 5? Some of the axioms, then, (such as Axiom 3) appear to have an empirical basis, while the source of others is not as clear. From whence comes the axiom, "high rank nations support the current international order?" Is this definition obvious, empirically tested, or what? A somewhat clearer exposition, then, seems to be called for in respect to what is definitional, what is empirically

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[49] Ibid., p. 8.

[50] Ibid., p. 7.

based, and indeed, whether the two propositions, which Rummel asserts to be empirically based, have been clearly brought into the axioms, as discussed above.

The putting together process, that is, the amalgamation of Status Theory with Social Field Theory, is treated under the topic headings of The Status-Field Space, Rank and Behavior, Status Disequilibrium and Behavior, Conflict and Cooperation, and Status Dynamics. Although all headings appear equal, presumably, and I hope that this is the correct interpretation, headings following the Status-Field Space are actually intended to be sub-headings of that category, in the sense that all of the axioms, theorems, definitions, and corollaries are part of the Status-Field Space. In my discussion I will not treat all of these developments, but will attempt to focus upon what appears to be possibly contentious points and which might, hopefully, generate further elaboration.

In treating "Social Space," Rummel creates a framework (by diagram -- see Appendix A) to show the relationship of certain theoretical concepts to the real world problems. Causal direction is directed throughout. For example, the differences and similarities of nations are depicted as being causal in respect to interaction. Interaction, in turn, is viewed as causal in respect to issues. Issues can take various paths -- conflict, which can lead to disruptions, which can lead to uncertainty, which can lead to aggression or miscalculation, which can lead to military violence and war, which can lead to resolution, which can lead to formal and informal accommodations, which can have impact on the similarities and differences of nations; or, reinforcement, which

can lead to resolution, which can lead to formal and informal accommodations, which can have impact on the similarities and differences of nations. Issues can also lead to alliances and commitments, which can lead to credibility, which can lead to threat of sanctions, which can have an impact upon accommodations, which can have impact on the similarities and differences of nations. In addition, accommodations have causal impact on reinforcement, conflict, issues, and interactions.

One question that can be raised, in connection with t[illegible] causal nexus, is the decision to limit that which flows from issues to either conflict or alliances and commitments (each contributing to additional causal chains). Intuitively, there seems no reason why issues cannot lead to immediate cooperation. To put it another way, it appears that issues can generate more than just conflict or alliances and commitments. That is, issues, it would seem, can generate immediate accommodations and cooperation, unless somehow the diagram is misleading. (Accommodation, in the model, only comes long after conflict.) To put it another way, isn't cooperation possible without previous conflict?

In his development of the notion of "structure of expectations" and its relevance to conflict, Rummel argues, "Conflict which disrupts the structure of expectations, however, provides the breeding ground of violence. A case in point is the Cuban Missile Crisis."[51]

I am somewhat uncertain as to what the case illustrates. Most would agree, I suppose, that the structure of expectations was disrupted during the Cuban Missile Crisis, but, in fact, the Cuban Missile Crisis

[51] Ibid., p. 14.

did not lead to violence. If this proposition can be interpreted to read, "expect more violence in those situations where the structure of expectations is disrupted as opposed to those situations where the structure of expectations is not disrupted," the Cuban case does not appear to be a supporting one. Also, the exact relevance of this proposition to the axioms of Social Field or Status Theory is not clear. On this important point, Rummel asserts:

> Uncertainty resulting from disrupted expectations may cause conflict behavior, such as expulsions or calls of diplomats, threats, boycotts, severence of diplomatic relations; or warning and defensive actions may ensue, like alerts, cancellation of military leaves, troop movements, and so on. Uncertainty and such actions can lead, in their cumulative effects, to either side miscalculating and stumbling into war. The events and decisions leading to World War I provide a powerful historical example of this process. The events leading to the Japanese-American Pacific War in 1942 is yet another example.[52]

It might be useful, in the case of the two examples, World War I and the Japanese-American Pacific War, to indicate what the disrupted expectations were, to facilitate interpretation of the proposition. Also, if the central proposition is, "in cases of disrupted expectations, expect conflict and violence, rather than cooperation," I am not convinced of the intuitive or empirical basis of this proposition. If I expect someone to hate me and want to do me in, but they give me a new car and $1,000, and thus disrupt my expectations, would we predict conflict behavior to flow from such disruption of expectations? That is, in the development of these points, Rummel seems to be emphasizing the possible

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[52] Ibid., p. 15.

negative consequences of disrupted expectations without recognizing that there may be positive consequences as well, in the sense of facilitating cooperation instead of conflict. If this point be granted, then the schematic diagram would have to be altered to incorporate this possibility.

Scattered throughout the discussion of "Social Space" are additional propositions whose relationship to the axioms of Social Field Theory and Status Theory appear unclear. For example, consider the proposition, "Ambiguity about a nation's resolve to use force or apply sanctions as threatened leads other nations frequently to test this resolve."[53] Is this being offered as a testable proposition, or is one to assume that someone has indeed empirically tested it? The statement does not appear to be obviously true, and its relationship to Status-Field Theory is not apparent. A large collection, then, of statements about "Social Space" are given but their value and relationship to Status-Field Theory is uncertain. Are these statements already tested, to be tested, related to the axioms, or what?

In developing Theorem 1, titled "Finite Dimensionality Theorem," and given as "A finite set of linearly independent dimensions generate attribute and behavior spaces,"[54] Rummel argues:

> This finite dimensionality follows from the finite nature of the social space-time population of nations. Each space can be represented by a coordinate system: each nation at a point in time is an attribute space coordinate; each dyad at a point in time is a behavior space coordinate. The infinitude of attributes and behaviors then have projections onto the nation or

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[53] Ibid., p. 18.

[54] Ibid., p. 19.

dyad axes which locate them in this social space-time. Therefore, since these coordinate axes are finite in number, there also must be a finite number of linearly independent dimensions.

So far, attributes and behavior are vectors in a social space-time, defined by a set of linearly independent dimensions. The theorem's power lies in its definition of a finite set of dimensions capturing all independent nation variation along, potentially, an infinite number of attributes (like area, national income, or defense budget) and behaviors (like exports, threats, and foreign mail), and in also capturing all nation variation along the infinite linear combinations of these attributes and behaviors. Thus if X_j and X_k are attribute space vectors such as population and GNP, then any vector $X = \alpha_j X_j + \alpha_k X_k$ (where α_j and α_k are any real number scalars) is also an attribute space vector, along which nation variation is defined by the theorem's linearly independent dimensions.

The dimensions generating each space are a basis of the space, and this concept will tie international behavior to nation attributes. By Theorem 1, any attribute or behavior space vector is linearly dependent on the space's basis. Therefore, if X is an attribute and $S_1, S_2, \ldots, S_p$ are a p dimensional basis of attribute space, then $X = \alpha_1 S_1 + \alpha_2 S_2 + \ldots + \alpha_p S_p$. Now, if behavior Y is linked to any attribute X, such that $Y = \gamma X$ and γ a scalar, then $Y = \gamma(\alpha_1 S_1 + \alpha_2 S_2 + \ldots + \alpha_p S_p)$.

In other words, if a behavior is dependent on any attribute or linear attribute combination, then it is dependent on the attribute space basis. Therefore, if linking behavior to attributes is our theoretical purpose, we need not conjecture about the infinitude of attributes. Rather, we should speculate about the finite dimensions.[55]

The previous discussion of the basis problem, then, has direct application here. In what sense can we say that we have captured "all nation variation along the infinite linear combinations of these

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[55] Ibid., pp. 19-20.

attributes and behaviors?"[56] If the previous arguments are accepted, this is always unknown except in the trivial case.[57] An additional point might be made, however. It is also possible to view the nations as "infinite," out of which we are currently observing a sample. For example, nations might be viewed as infinitely generated over infinite time, and also distributed over infinite space. In this context we presently observe nation behavior on earth and there are approximately 130 units. It is possible, then, that Status-Field Theory applies to units not yet discovered in other systems and that possibly the number of units is infinite. To put it another way, astronomers have not yet finally concluded whether the universe of space is finite or infinite, and, if it is infinite, the earth nations could be viewed as constituting a sample of infinite nations over time and space. At first glance, all this sounds very far-fetched but it might be another way of conceptualizing the theory. If it is conceptualized in this broader sense, however, the original observations concerning the basis problem still remain.

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[56] It should be noted that even if the above statements are viewed in a purely theoretical sense, that is, if we ignore the problems of operationalization brought in by factor analysis, canonical correlation, etc., a basis problem is still apparent. Consider the above statement, "If a behavior is dependent on any attribute or linear attribute combination, then it is dependent on the attribute space basis." Using the previous notation, D, the distance vectors, not C, the A-space dimensions, is used in testing the basic equation and we already know from previous discussion that it does not span an infinite number of new arbitrary columns. If it did, that is, was truly a basis of an infinite set of new columns, it would make the basic equation true by definition, as discussed earlier.

[57] That is, the case which makes the definitions true, by definition. To repeat the argument, a square and non-singular matrix on the predictor side, in the case of multiple regression, and on either side, in the case of canonical correlation, will allow, through appropriate transformation, perfect fit. If a matrix is not square and non-singular, an additional column may or may not be linearly dependent upon it.

In further discussing the problem of generating the dimensions, Rummel asserts:

> Attempts to delineate empirically reliable behavior space dimensions for 1955 and 1963 have been published ... Those dimensions appearing for both years are Deterrence (military action and negative communications), Diplomatic, Cold War, International Organizations, UN Voting Agreement, Negative Sanctions, Exports (relative), Students, Migrants, and Salience (involving such benavior as book exports, total exports, conferences, and tourists). Although the conceptual framework can readily include these dimensions, they are still cross-sectional dimensions (delineated as points in time). Relating them to the conceptual framework should be postponed until it is determined whether they also exist through time.[58]

Again, the previous observations concerning the basis problem seem to apply. The method so far employed, factor analysis, with 1.0 eigenvalue cutoff, does not, as indicated, generate a basis for even a sample space. If this argument is accepted, clarification in this regard is necessary. If it is granted that an "approximate basis" rather than a basis is obtained, this does seem to create some difficulties for the theory. That is, the variance given up by obtaining an approximate basis may be important explanatory variance in respect to the two spaces. Further, a problem related to sampling through time, as suggested in the quotation, requires further explanation. There is an obvious difference between factor analyzing at various points in time, and comparing factor structure, and factor

[58] Ibid., p. 20.

analyzing across time, as in super-P factor analytic applications.[59] The statement, "Relating them to the conceptual framework should be postponed until it is determined whether they also exist through time," becomes questionable, if super-P factor analysis is employed. That is, the application of the super-P factor analytic technique will yield an approximate basis through time, although, of course, this must be conceptualized as bounded time. That is, after application, it might be stipulated that an approximate basis has been generated for the years 1950-1965, or 1950-1970, etc. It should be clear, however, that even if this approach is taken, it cannot be known whether the approximate basis applies outside of the time period utilized, which brings us back to our discussion of the "Time and Space Frame Problem."

In treating Definition 2, titled "Status Dimensions Definition," and given as "The international status dimensions are economic development and power,"[60] Rummel asserts: "But why posit economic development and power as status dimensions? These are the only consistently delineated national dimensions invoking international consensus about what is desirable."[61]

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[59] A discussion of super-P factor analysis and its potential for Social Field Theory applications can be found in R. J. Rummel, "Forecasting International Relations: A Proposed Investigation of 3-Mode Factor Analysis," Technological Forecasting, Vol. I (1969), pp. 197-216.

[60] R. J. Rummel, "A Status-Field Theory of International Relations," op. cit., p. 28.

[61] Ibid.

Most would agree, I think, that if the majority of persons in the world were polled, they would wish their country to possess these characteristics, but it is not clear that there is a consensus in that respect. For example, concerning high economic development, as the pollution consequences of such development are becoming clear, a number of people might argue that it is better to have middle-range economic development and avoid some of the injurious consequences that seem to follow from higher level development. Remembering that the power dimension has substantial loadings of large population, large land areas, etc., again, would a consensus obtain on this point? Would the Swiss really like to have the population and land area of India, for example? In short, is the consensus as clear as the above passage seems to imply?[62] If not, does this make any difference in predicting status dependent behavior? If the majority of those in some countries would reject the characteristics loading heavily on the power dimension as being desirable, what does this do to the theory? (In fact, without attempting to prove the point, I feel that a substantial number of statements could be garnered from statement from smaller countries, emphasizing how desirable it is that they are small, given the problems of world management and conflict levels of the larger countries.)

Further discussing these two dimensions, Rummel asserts:

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[62]This is not to say that such a consensus cannot be assumed for theoretical purposes.

> Status-Field Theory does not define the attribute of behavior space dimensions as mutually orthogonal (statistically independent). They are only linearly independent, a less restrictive condition satisfied when the dimensions are not perfectly correlated. Theoretically, therefore, the two status dimensions are permitted to have a significant correlation, accords more with status theory than restricting them to zero correlations (orthogonality).[63]

It should be pointed out that this is a decided shift away from the stress on orthogonal dimensions as given earlier in Social Field Theory exposition. In addition, in fact, the methods presently employed create orthogonal dimensions. That is, present applications rotate to an orthogonal solution and, therefore, the Economic Development and Power dimensions are, in fact, orthogonal. It is not clear, then, in view of the previous stress on orthogonality and the actual methods employed, why this shift to a less restrictive condition is made at this point.

Rummel also asserts:

> Another aspect of the Status Definition should be discussed. Achieved and ascribed status dimensions are distinguished by their nature: economic development is the achieved status dimension; power, the ascribed.
>
> Economic development comprises per capita attributes like GNP, energy consumption, telephone, and vehicles per capita. By a generation's effort, a nation can change significantly these attributes, relatively, as have Japan, Taiwan, and West Germany. On the power dimension, however, which includes men under arms, area, national income, resources, and energy production, a nation cannot alter so easily its status. Resources are fixed and unchangeable. Moreover, the population base limits the number that can be placed under arms. The underdog power status of a nation of two million population is fundamentally frozen compared to those having 50, 150, and 250 millions. And national income, Organski's power

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[63] Ibid., p. 31.

> index, is tied to the population base. Economically underdeveloped nations like India and China have, nonetheless, higher national incomes than economically developed ones like Canada, New Zealand, Australia, Switzerland, Japan and Norway. Although economic development sharply increases national income, this cannot overcome the power anchor that is a small population. Power capability, even in the nuclear age, is locked into a nation's size.[64]

This appears to me to be an unnecessary distinction, and neither empirically nor intuitively obvious. That is, it is not clear that a nation can change its economic development significantly within a generation. Nor is it clear that it cannot change its power in a generation. In fact, some variables which load heavily on the Power dimension seem easier to change, impressionistically, than those that primarily define the Economic Development dimension. For example, the Number of Men under Arms, loading heavily on the Power dimension, can be, in fact, changed radically within the space of a few months or a year. Area, also loading heavily, can be changed quickly in a short space of time, as in the case of Great Britain divesting herself of her Empire. Russia, it might be recalled, with the Treaty of Brest Litovsk, also radically changed, in a very short period of time, her land area. It is true that resources are not easily changed, but a number of things other than resources, help define the Power dimension, and, as I have indicated, do seem susceptible to change within a generation. It is even conceivable that population could be changed radically within a generation through genocide policies, etc. In short, I do not believe that these two dimensions have been correctly characterized by the

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[64] Ibid., p. 38.

notions of "achieved" and "ascribed" and it is not clear how they add to the theory.

In this connection, the assertion, "With their limited but modern weapons, contemporary low power status nations would have had the highest power status a century ago,"[65] can also be questioned. That is, the statement would be true only if the Power dimension had one heavy loading, that is, modern weapons. As previously pointed out, however, this dimension must be thought of in multivariate terms. And, therefore, the statement is false, if the nations referred to also have small populations, small land areas, etc. In other words, there is an apparent tendency here to equate military power with the Power dimension, whereas, as pointed out, it is defined by many other important variables.[66]

In developing Corollary 2, titled, "Status Position Corollary," and given as, "An attribute space position defines a nation's relative status,"[67] it is asserted: "The social space-time origin is the mean of all attributes over time; all attributes are theoretically standard units (each attribute mean equals zero and standard deviations equal unity)."[68] This latter statement, it would appear, needs clarification. Is the time base referred to infinite time, or simply the time incorpor-

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[65] Ibid., p. 35.

[66] This argument should not be seen as undercutting Rummel's major point, that power is relative and shifts over time.

[67] Ibid., p. 34.

[68] Ibid.

ated in a particular study, i.e., 1950-1970? The discussion of the space-time frame presented earlier might be recalled here and what the theory applies to, in time and space, may hinge on such clarifications.

In developing Theorem 5, titled, "Equilibration Theorem," and given as, "Nations having unbalanced statuses desire to balance them,"[69] it is argued: "This follows from the Mobility Theorem and the status disequilibrium axioms and theorems given below. The mobility and Equilibration Theorems jointly imply that a nation will emphasize equilibration over mobility."[70]

This might imply that a nation like Luxemburg, which stands high on the Development dimension, may not emphasize its development because it stands low on the Power dimension, and it should be recalled that, presumably, Luxemburg cannot significantly improve its power position because it is "ascribed." This appears counter-intuitive and the question arises as to whether it is proper deductive inference for nations like Luxemburg, Denmark, the Netherlands, etc.

The same problem reasserts itself in the assertion, "The Equilibration Theorem says that an MU status nation, for example, will try to raise the U status to an M. The Mobility Theorem rules out equilibration by increasing M to an U."[71] This asserts something that, in terms of

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[69] Ibid., p. 36.

[70] Ibid.

[71] Ibid., p. 37. Rummel uses T to refer to "topdog" nations, or those with high status, M to designate "middledogs" holding middle status, and U to refer to "underdogs," or those holding low status. Economic development status is noted first and power status second. For example, MU indicates middledog in respect to economic development and underdog in respect to power.

previous discussion, appears peculiar. That is, it asserts that nations will try to raise something that they cannot raise (in a generation), that is, raise their status on the "ascribed" power dimension. This appears to be another good reason to dispense with the distinction between achieved and ascribed status. These statements, then, appear counter-intuitive. They imply that a nation that is low on the Power continuum will be more concerned with matters loading heavily on that dimension, i.e., Area, Men Under Arms, Resources, etc., than concentrating, instead, on furthering economic development.

Concerning Corollary 3, titled, "Elite Corollary," and given as, "A nation's elite identify with their rank and status configuration,"[72] it should be clear, from subsequent discussion, that this corollary ought to be re-phrased as "A nation's elite identify with their nation's rank and status configuration."

Concerning Definition 8, titled, "Status Behavior Definition," and given as, "The status dependent behavior dimensions delineate status behavior,"[73] it is argued:

> Before posing particular status behaviors, the range of status dependent behaviors should be noted. Status theorizing and international relations applications do not delimit status behavior well and statements in the literature sometimes imply that all behavior is status dependent. In contrast, the status-field theory formulation given here sharply limits status dependent behavior. Since only two status dimensions exist, they linearly can explain no more than two behavior dimensions. This conclusion is based on the mutual linear independence of all the behavior dimensions (Finite Dimensionality Theorem) which include the two status ones.[74]

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[72] Ibid., p. 39.

[73] Ibid., p. 51.

[74] Ibid., pp. 51-52.

Although it is true that two sets of attribute distance dimensions can explain no more than two behavioral dimensions, linearly, it should be pointed out that it is possible they can explain portions of, that is, fractions of, many behavioral dimensions.

Concerning Axiom 9, titled, "Economic Development Status Axiom," given as, "The more similar in economic development status, the more nations are mutually cooperative,"[75] it is argued that:

> Economic development is an achieved status dimension and common achievement is a strong international bond. Nations having similarly high development share much scientific and technological knowledge and ability, consumer demands and requirements, and socio-economic forces. They have a common pride of achievement, a need and desire to interact, to exchange, to coordinate. The undeveloped nations cooperate with each other to pool resources for economic development and to coordinate their interests, regarding the developed nations.
>
> Common ascribed status on the power dimension, however, is not such a force for cooperation. Certainly, similar power status provides an interest and some basis for understanding and communication. However, the accidental and relatively unchangeable nature of national power weakens whatever support it gives for cooperation. Power is like race as an ascribed status in America. Race furnishes common interests (e.g., as against whites or blacks), but is a weak force per se toward cooperative behavior.[76]

The argument that similarity in respect to achieved status is more likely to generate cooperation than similarity in respect to ascribed status appears a possibility, but questionable. That is, it would seem,

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[75] Ibid., p. 69.

[76] Ibid., pp. 69-70.

impressionistically, that there have been a number of states which have been highly similar economically, such as Germany, France, and England, but have exhibited low cooperation.[77]

Concerning Theorem 9, titled "Economically Underdeveloped Conflict Theorem," given us: "For economically underdeveloped actors, status conflict behavior [may be defined as] $CF_{i\to j} = -a^*_{i1}d_{i-j,1} + a^*_{i2}d_{i-j,2}$,"[78] it is asserted that, in connection with Table 2 (See Appendix B), "For TT and TU actors, conflict is directed most toward the UT object and least toward the TT,"[79] and this is not consistent with the table. In the case of TT, the least conflict is directed toward TU and not TT. The statement is also incorrect in respect to TU where the least conflict is directed toward TU and not TT.[80]

Finally, concerning Theorem 10, titled "Economically Developed Status Behavior Theorem," given as: "The status dependent cooperation and conflict behavior of economically developed nations to others is a function of their power incongruence, that is, $CO_{i\to j} + CF_{i\to j} = -\gamma_2 d_2$,

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[77] This assertion assumes that the distinction between achieved and ascribed status is a meaninful one (for the sake of argument). Also, it directs itself solely to Axiom 9 without consideration of subsequent elaborations, as, for example, as given in Theorem 10.

[78] Ibid., p. 74. Asterisks are used here by Rummel to distinguish these parameters from those in the cooperation theorem.

[79] Ibid., p. 75.

[80] It is apparent, then, that clarification is needed on this point. That is, the verbal description should accord with the table. These discrepancies apparently resulted from typographical errors and I simply use this medium to alert readers in this respect.

γ_2 is a positive parameter equaling $(a_2^* + a_2)$, and d_2 is the i-j congruence (distance vector) on the power status,"[81] and Theorem 11, titled "Economically Underdeveloped Status Behavior Theorem," given as: "The status dependent cooperation and conflict behavior of economically underdeveloped nations to others is a function of their economic development incongruence, that is, $CO_{i\to j} + CF_{i\to j} = -\gamma_1 d_1$, where CO is nation i to j cooperative behavior, CF is conflict behavior, γ_1 is a positive parameter equaling $(a_1^* + a_1)$, and d_1 is the i-j incongruence (distance vector) on the economic development status,"[82] some questions can be raised about the relationship of these notions to the previous exposition. Earlier it has been stressed that linkages in respect to status, that is, the situation of i and j occupying the same status positions, facilitates cooperation between actors. Yet, here it is asserted that as actors approach the same status, for example, in the case of the economically developed actors approaching the same status in respect to their power, we can expect more conflict and or cooperation. In this connection, Rummel maintains, "Power congruence is for the high power nations, such as the U.S.S.R., the U.S., and China, the same as power parity. And the greater their power parity, the more their joint conflict and cooperative status dependent behavior."[83] However, in applying the developed nations' formula, if a = 5, b = 3, c = 2, and d = 10, on the power dimension, we would get, using 1 as our parameter,

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[81] Ibid., p. 78.

[82] Ibid., p. 79.

[83] Ibid., p. 78.

$$CO_{a \to b} + CF_{a \to b} = -(5 - 3) = -2$$

$$CO_{a \to c} + CF_{a \to c} = -(5 - 2) = -3$$

$$CO_{a \to d} + CF_{a \to d} = -(5 - 10) = +5$$

Thus, a would be predicted to have the highest CO + CF with d, the least CO + CF with c, and b would stand between - even though b "approaches a closer than d or c.[84] Further discussion, then, of the implications of these important formulae seem to be in order.

In short, as one investigates Rummel's discussion of the "Status-Field Space," there seem to be a number of places where fuller treatment and exposition would be useful.

Final Note

As stated in the beginning, the purpose of this paper was to discuss various Social Field Theory elaborations in the hope of stimulating further debate and discussion on what appears to be possible contentious points. In this connection, the preceding observations should be taken entirely in that spirit, and not as an endeavor to discredit. That is, it is hoped that these comments will lead to a further development of what appears to be the most sophisticated and possibly useful tool yet generated in the field of international relations.

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[84] This example assumes both a and d are high power nations. The text is consistent with the formula if a high power nation is related to just lower power nations. It creates problems when high power nations are related to one another.

APPENDIX A

Social Space

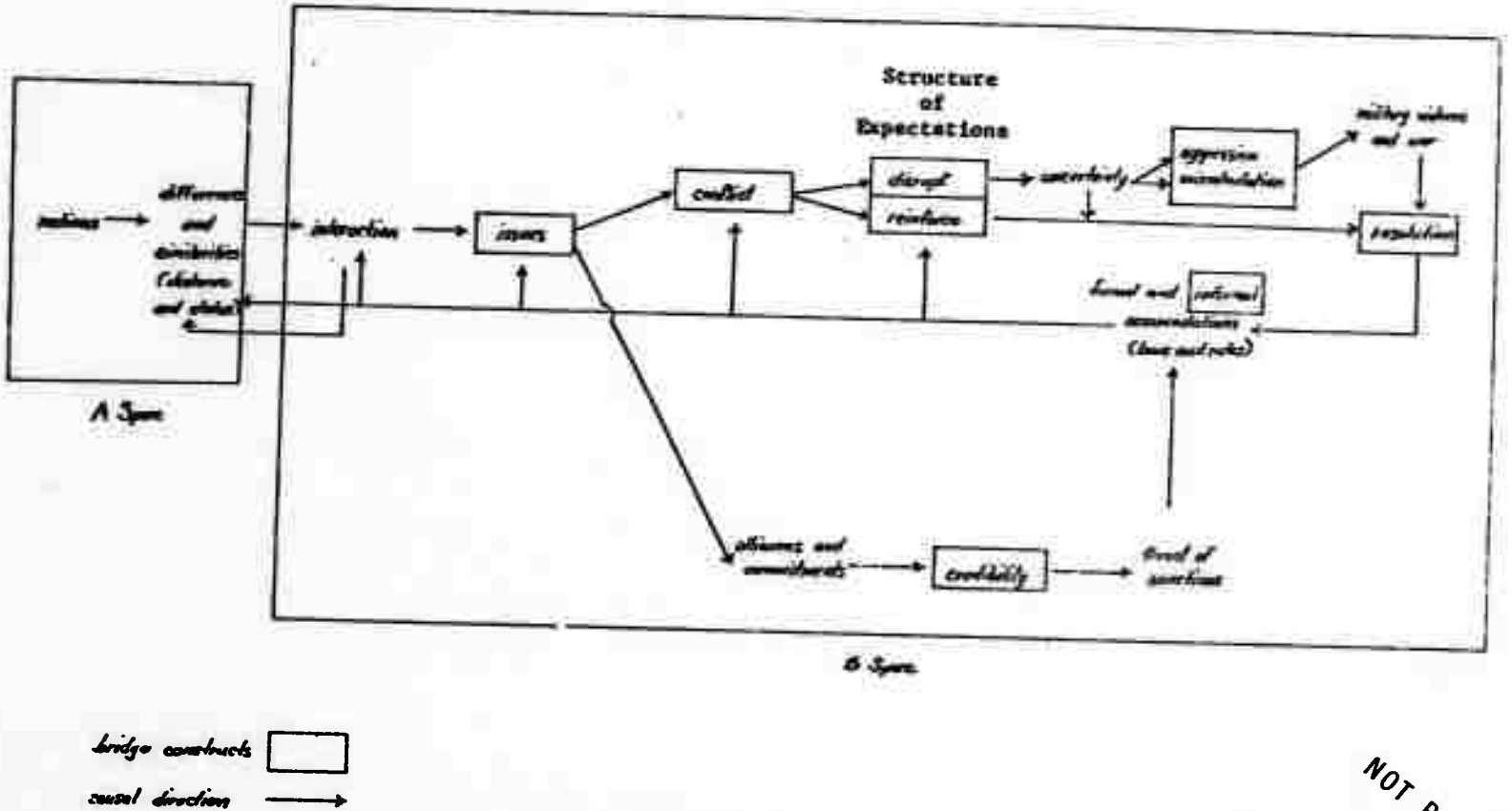

Figure 1

NOTE: This is taken from R. J. Rummel, Research Report No. 50, "A Status-Field Theory of International Relations," Dimensionality of Nations Project, University of Hawaii, 1971, p. 11.

APPENDIX B

Table 2*

Status Differences and Conflict Behavior

THEOREM 6

Statuses		Status Differences			Conflict
actor i	object j	$d_{i-j,1}$	$- d_{i-j,2}$	=	Rank
TT	TT	0	0	0	1.5
	TU	0	-1	-1	4
	UT	1	0	1	1
	UU	1	-1	0	1.5
TU	TT	0	1	1	1.5
	TU	0	0	0	4
	UT	1	1	2	1
	UU	1	0	1	1.5

THEOREM 7

i	j	$-d_{i-j,1}$	$+ d_{i-j,2}$	=	Rank
UT	TT	1	0	1	1.5
	TU	1	1	2	1
	UT	0	0	0	4
	UU	0	1	1	1.5
UU	TT	1	-1	0	1.5
	TU	1	0	1	1
	UT	0	-1	-1	4
	UU	0	0	0	1.5

*To do the arithmetic indicated by the theorems, T is given a value of 1 and U a value of zero. For simplicity, the parameters in the theorems are assumed equal to 1.

NOTE: This is taken from R. J. Rummel, Research Report No. 50, "A Status-Field Theory of International Relations," Dimensionality of Nations Project, University of Hawaii, 1971, p. 76.

APPENDIX C

Axiom 1 (Status-field Axiom): International relations is a field consisting of all nations, the attributes and interactions, and their complex interrelationships through time.

Axiom 2 (Attribute-behavior Space Axiom): The international field comprises a Euclidean attribute space defining all the attributes of nations and a Euclidean behavior space defining all nation dyadic interactions.

Theorem 1 (Finite Dimensionality Theorem): A finite set of linearly independent dimensions generate attribute and behavior spaces.

Axiom 3 (Stratification Axiom): International relations is a stratified social system.

Theorem 2 (Status Theorem): Status dimensions are a subset of attribute space dimensions.

Definition 1 (Status Definition): A status dimension (of attribute space) is a continuum involving virtually universal international consensus as to which end is better or more desirable. An ascribed status dimension is one on which nations cannot alter significantly, their relative status in a generation. An achieved status dimension is one on which nations can so alter their location. A nation's rank is its total status on the status dimensions.

Corollary 1 (Status Measurement Corollary): Status is a continuous variable.

NOTE: Appendix C is taken from R. J. Rummel, Research Report No. 50, "A Status-Field Theory of International Relations," Dimensionality of Nations Project, University of Hawaii, 1971, pp. 87-91.

Definition 2 (Status Dimensions Definition): The international status dimensions are economic development and power.

Theorem 3 (Position Theorem): Nations are located as vectors in attribute space and as vectors of nation dyads in behavior space.

Corollary 2 (Status Position Corollary): An attribute space position defines a nation's relative status.

Theorem 4 (Mobility Theorem): Nations desire upward mobility.

Theorem 5 (Equilibration Theorem): Nations having unbalanced statuses desire to balance them.

Corollary 3 (Elite Corollary): A nation's elite identify with their rank and status configuration.

Definition 3 (Rank Definition): The rank of i is $\alpha_1 s_{i1} + \alpha_2 s_{i2}$, where α_1 and α_2 are positive parameters and s_{i1} and s_{i2} are nation i's economic development and power statuses, respectively.

Definition 4 (Joint Rank Definition): The joint rank of two nations, i and j, is $\alpha_1(s_{i1} + s_{j1}) + \alpha_2(s_{i2} + s_{j2})$, where α_1 and α_2 are the positive parameters in Definition 3.

Definition 5 (Status Disequilibrium Definition): A nation's status disequilibrium is $\pm \alpha_1 s_{i1} \mp \alpha_2 s_{i2}$, where α_1 and α_2 have different signs.

Definition 6 (Status Incongruence Definition): The status incongruence of two nations i and j is $\pm \alpha_1(s_{i1} - s_{j1}) \mp \alpha_2(s_{i2} - s_{j2})$, where α_1 and α_2 have different signs.

Corollary 4 (Status Distance Corollary): Status incongruence between nations i and j is the distance vector between their status vectors on a status dimension.

Axiom 4 (Attribute Distance Axiom): Between nation attribute distances at a particular time are social forces determining dyadic behavior at that time.

Axiom 5 (Status Dependence Axiom): Some behavior dimensions are linearly dependent on status.

Definition 7 (Status Role Definition): The status dependent behavior dimensions define a nation's status role.

Definition 8 (Status Behavior Definition): The status dependent behavior dimensions delineate status behavior.

Axiom 6 (Rank Behavior Axiom): Status behavior is directed toward higher ranking nations and the greater a nation's rank, the more its status behavior.

Axiom 7 (Status-Quo Axiom): High rank nations support the current international order.

Theorem 6 (Cooperation Theorem): The higher the joint rank of nations i and j, the more cooperative their behavior. That is, $CO_{i \leftrightarrow j} = -\alpha_{i1}d_{i-j,1} - \alpha_{i2}d_{i-j,2}$, where $CO_{i \leftrightarrow j}$ is a behavior space cluster of highly intercorrelated cooperation vectors.

Axiom 8 (Dominant Status Axiom): Nations emphasize their dominant status and the others' subordinant statuses in interaction.

Corollary 5 (Dissonance Corollary): Status disequilibrium causes cognitive dissonance.

Corollary 6 (Status Link Corollary): Common statuses between nations provide them with similar interests and a communication bridge.

Corollary 7 (Uncertainty Corollary): The more two nations are status incongruent, the more their relationships are uncertain and the more incongruent their expectations of each other's behavior.

Axiom 9 (Economic Development Status Axiom): The more similar in economic development status, the more nations are mutually cooperative.

Theorem 7 (Conflict Theorem): Two nations' status incongruence is correlated with their mutual status dependent conflict behavior.

Theorem 8 (Economically Developed Conflict Theorem): For economically developed actors, status dependent conflict behavior $CF_{i \to j} = \alpha^{*}_{i1} d_{i-j,1} - \alpha^{*}_{i2} d_{i-j,2}$.

Theorem 9 (Economically Underdeveloped Conflict Theorem): For economically underdeveloped actors, status dependent conflict behavior $CF_{i \to j} = -\alpha^{*}_{i1} d_{i-j,1} + \alpha^{*}_{i2} d_{i-j,2}$.

Theorem 10 (Economically Developed Status Behavior Theorem): The status dependent cooperation and conflict behavior of high economically developed nations to others is a function of their

power incongruence, that is $CO_{i \to j} + CF_{i \to j} = -\gamma_2 d_2$, where CO is nation i to j cooperative behavior, CF is conflict behavior, γ_2 is a positive parameter equalling $(\alpha_2^* + \alpha_2)$, and d_2 is the i-j incongruance (distance vector) on the power status.

Theorem 11 (Economically Underdeveloped Statue Behavior Theorem): The etatus dependent cooperation and conflict behavior of economically underdeveloped nations to others is a function of thair economic development incongruence, that is $CO_{i \to j} + CF_{i \to j} = -\gamma_1 d_1$, where CO ie nation i to j cooperative behavior, CF is conflict behavior, γ_1 is a positiva parameter aqualling $(\alpha_1^* + \alpha_1)$, and d_1 and i-j incongruence (distance vector) on the economic development etatue.

Theorem 12 (Status Time Theorem): Tha statue dependent behavior of nation i to j at time t is linearly depandent on their status distance vectore at time t.

Theorem 13 (Behavior Dependence Thaorem): Behavior epaca is a eubepace of attribute space.